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(54) Support helix for a radially expanded resilient sleeve.

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Description

Technical Field

The invention relates to a support helix for a radially expanded resilient sleeve that can be removed from the sleeve by pulling on one end of the helix material to pull the helix apart and out of the sleeve and to a device for manufacturing the support helix.

Support helices serve to permit a convenient application of radially pre-expanded resilient sleeves on elongate objects, for example electrical cables. After the support helix with the sleeve on it is slid onto the electrical cable over a cable connection or other break in the cable sheath, it only is necessary to pull the support helix out between the sleeve body and the cable to allow the sleeve to shrink tightly onto the cable.

Background Art

The prior art includes support helices formed by a tube grooved in a helical line as disclosed in U.S. patent No. 3,515,798. However, it is difficult in manufacturing such a support helix to make a groove that will allow the helix to be pulled apart easily while maintaining sufficient strength to hold the helix together and support the resilient compression of the expanded resilient sleeve.

To overcome the above noted problem, the support helix of U.S. patent No. 4,389,440 is wound from a ribbon, and the connection areas are produced by welding or tacking. This is, however, an expensive process for making the helix. Another solution, disclosed in U.S. patent No. 4,503,105, is to make the tubular base body with a constant wall thickness, to include circumferentially spaced longitudinal ribs on the inside wall of the body and to cut through the constant wall thickness in a helical pattern leaving the spaced ribs to hold the helix together. This requires more material in the support helix and a larger diameter support helix for a specified internal clearance for the cable or other article to which the resilient sleeve is to be applied.

The objective is, of course, to make the support helix of an inexpensive material and to produce it inexpensively with as high as possible a strength against the compression force exerted by the sleeve while at the same time producing a helix that will unwind with as small a force as possible.

Disclosure of the Invention

According to a first aspect of the present invention there is provided a support helix for a radially expanded sleeve of resilient material which may be used as an enclosure of an elongate object such as an electrical cable, the support helix being formed by a tubular base body and having adjacent turns interconnected in circumferentially distributed connection areas, with non-interconnected circumferential areas of substantially the same wall thickness as the interconnected areas being provided therebetween, the non-interconnected circumferential areas being formed by cuts extending through the wall thickness of the base body, the support helix comprising an end portion which extends from one end of and through the support helix and can be gripped at the other end of the support helix, the connection areas being dimensioned so that the support helix can be manually unwound by pulling on the end portion, characterized in that the tubular base body has a circumferentially smooth inner surface devoid of axially extending ribs to provide an essentially uniform wall thickness; and the cuts are spaced circumferentially in a helical pattern along the base body.

The present invention provide a support helix for a radially expanded sleeve of resilient material, which can be manufactured in a simple manner and which has a high radial strength, and a device for cutting the helix. The support helix comprises a tubular base body through which circumferentially spaced cuts are formed in a helical pattern along the entire length of the base body. One end portion of the helix is separated from the helix into a strip extending from one end of the helix through the support helix and out of the other end thereof where it may be manually grasped. The connection areas between the spaced cuts are dimensioned so that the support helix can be manually unwound by pulling on the end portion extending through the support helix.

According to a second aspect of the present invention there is provided a device for cutting the support helix in accordance with the first aspect of the invention, comprising a knife wheel adapted to be rolled on the tubular base body in a helical line having for forming the cuts, circumferentially distributed and circumferentially spaced, radially projecting knives having circumferential blades extending essentially in the circumferential direction.

Since the support helix of the invention is manufactured by providing cuts in the tubular base body, neither winding nor welding or tacking steps are necessary, whereby the manufacture is possible in an easier and more rapid way, and a more uniform product will be obtained. The position and distribution of the connection areas can be freely selected, whereby an optimum design with respect to strength is possible, and identical tubular bodies can be provided with different arrangements of connecting areas.

Since only cutting steps are required for making the support helix from the tubular base body,

high production speeds and a continuous production process can be realized with the device in accordance with the invention, and it is possible to serially manufacture support helices in mass production at low cost. For example, a continuously extruded tube can be simply cut into the desired lengths, and can be provided with the helical cuts prior to or after being cut into lengths. Variations of the size and/or the distribution of the connection areas are possible in a very simple manner by exchanging the knife wheel, or by changing the axial advance of the knife wheel per revolution of the base body relative to the knife wheel.

Brief Description of the Drawing

The invention will be subsequently described in more detail by means of embodiments illustrated in the drawing in which

Figure 1 shows in a perspective illustration, an enclosure which is provided with a support helix in accordance with the invention, prior to the application to a cable, with parts of the resilient sleeve surrounding the support helix being broken away;

Figure 2 shows in a perspective illustration, a preferred mode of manufacture of a support helix according the invention;

Figure 3 illustrates in a radial sectional view details of the cutting process and the knife wheel;

Figure 4 is a radial view of a knife in the sense of the arrow IV of Figure 3, somewhat enlarged as compared to Figure 3;

Figure 5 illustrates, in a representation similar to Figure 2, a possible mode of manufacturing a support helix according to the invention from a grooved base body;

Figure 6 shows details of Figure 5 in an axial sectional view enlarged as compared to Figure 5; and

Figure 7 is a plan view in section of a modified embodiment of a device for manufacturing support helices.

Detailed Description

Figure 1 illustrates a support helix 1 inside a radially expanded sleeve 3 of resilient material, for example a polyurethane elastomer. Adjacent turns 5, 7 of the support helix 1 are interconnected in connection areas 9, 11 which are distributed across the circumference of the support helix 1, with non-interconnected circumferential areas being therebetween which essentially have the same wall thickness as the interconnection areas. The support helix 1 has an end portion 15 which is separated from the helix into a strip and extends from one end 13 of the support helix 1 through the support helix and can be gripped at the other end 17 of the support helix. The connection areas 9, 11, are dimensioned so that the support helix 1 can be manually unwound towards its interior by pulling at the end portion 15.

Figure 1 illustrates the enclosing of an end portion of an electrical cable 19, as a usual application. The diameter of the cable 19 is smaller than the internal diameter of the support helix 1 but larger than the internal diameter which the resilient sleeve 3 would have in a non-expanded condition; accordingly, the cable 19 can be easily put through. Upon withdrawing the support helix 1, the sleeve body 3 will progressively constrict on the cable 19 and will finally tightly enclose the latter with a resilient bias.

The support helix 1 is formed by a tubular base body 21 in which the non-interconnected circumferential areas are formed by cuts 23, 25, which extend through the wall thickness of the base body 21. In the illustrated embodiment, the tubular base body 21 has an essentially uniform wall thickness and consists of an extruded smooth plastic tube for which a particular design is not necessary.

In the illustrated embodiment, the cuts 23, 25, are mutually offset in the circumferential direction 27 of the support helix 1, whereby the formation of linearly aligned non-interconnected areas is avoided. This increases the strength of the support helix 1.

Figure 2 illustrates a method mode of manufacturing the support helix 1 by means of a device 29, which comprises a knife wheel 31 as an essential component. The knife wheel can be rolled on the tubular base body 21 in a helical line. To that end, the knife wheel 31 is supported in a cutting head 33 which is displaceable in a guide 35 and can be moved in the guide by means of a rotatable spindle 37. Beside the cutting head 33, the tubular base body 21 is attached, with its axis being parallel to the guide 35, in a fixture 39 which engages the ends of the base body 21 and can be rotatably driven by means of a gear motor 41. The gear motor 41 also drives the spindle 37, via a coupling 43, with a predetermined transmission ratio. A device, not illustrated, presses the knife wheel 31 onto the base body 21. For forming the cuts 23, 25, the knife wheel 31 has circumferentially distributed, radially projecting knives 45 with circumferentially extending circumferential blades 47.

In operation, the gear motor 41 rotates the fixture 39, with the base body 21 clamped therein, and the spindle 37 with predetermined rotational speeds. Thereby, the knife wheel 31 rolls on the base body 21 in a helical line 47, the pitch of which depends upon the ratio of the rotational speeds of

the base body 21 and the spindle 37. In this operation, the knife wheel produces the cuts 23, 25.

Figures 3 and 4 illustrate the cutting process with a preferred design of the knife wheel 31. The knives 45 have lateral faces 49, 51 which extend generally radially and merge towards the circumferential blade 47 to form lateral blades 53 and 55, respectively. Thereby, the penetration of the knives 45 into the wall 57 of the base body 21 is facilitated. In the illustrated embodiment, the lateral faces 49, 51 have a convex curvature and the knives 45 have a hollow grinding 59, 61 on both sides (Figure 4). Both of these features also facilitate the cutting process.

Figure 5 illustrates an alternative tubular base body 521 which has a helical circumferential groove 63. Such a base body can be manufactured in mass production for instance by blow molding and offers the advantage that the circumferential groove 63 determines the advance of the knife wheel 531 so that no special advancing device (e.g. the spindle 37 shown in Figure 2) is necessary and it is possible to use base bodies which have portions 65, 67 of different diameters, as illustrated. Such base bodies can be useful if objects are to be enclosed which have portions of different diameters.

Figure 6 illustrates the cutting process with the base body 521 of Figure 5. The pre-shaped helical circumferential groove 63 facilitates the penetration of the knives 45.

Figure 7 illustrates a modified apparatus in which a guide 69 is provided for advancing a tubular base body 721 axially. The knife wheel 731 is rotatable by means of a motor 71. With such a device, it is possible to produce a desired helical line of cuts 723, 725, by axially advancing the base body along the driven knife wheel 731 which is stationary. In the illustrated embodiment, a particularly simple design and mode of operation is obtained in that the knife wheel 731 is designed and arranged for engagement into a helical peripheral groove 763 of the base body 721, the peripheral groove 763 defining the desired helical line. This will automatically result in the necessary axial advance of the base body 721.

Often it is appropriate to support the base body 721 towards the knife wheel 731 by at least one correspondingly arranged counter wheel in order to facilitate the cutting process. In the illustrated embodiment, such a counter wheel 73 is arranged so that it engages the base body 721 on its inside wall in an area which is disposed oppositely of the knife wheel 731. The counter wheel 73 has a circumferential recess 75 for the ends of the knives 745 penetrating through the wall 757 of the base body 721. The illustrated arrangement results in a particularly effective support in an extremely small space.

In the illustrated embodiment, the counter wheel 73 is also designed to engage a helical peripheral groove 763 of the base body 721; this peripheral groove is provided, in the illustrated base body 721, in the interior thereof. This will result in a support in an even more restricted space, and in an additional guiding of the base body 721.

In the illustrated embodiment, the guide 69 comprises a pin 79, and the counter wheel 73 is journaled on the pin. This results in a simple and compact structure. In order that the knife wheel 731 and the counter wheel 73 will cooperate without interference, the guide 69 is preferably designed, as illustrated, to provide a radial play of the base body 721. In the illustrated embodiment, the knife wheel 731 is attached together with its drive 71 and a switch 80, at a pivot plate 81 which can be adjusted by means of an arresting handle 83 about a pivot axis 85 disposed perpendicular to the plane of the drawing, between the illustrated working position and a rest position in which the knife wheel 731 is pivoted away from the guide 69. In this rest position (not illustrated), a fresh base body 721 can be put on the guide 69.

In the base body 721 illustrated in Figure 7, the described peripheral groove 763 is provided by the outer and inner sides, respectively, of a smoothly undulating structure, i.e. not by a sharp edge. It has been found that with base bodies of this design, substantially higher strengths are obtained than with sharp grooved base bodies, whereby applications become possible which are practically impossible with support helices known hitherto because of the required high supporting forces. Such a base body can be easily produced, for example, by blow molding. It will provide a high strength even after the cuts have been produced. Since there are no axially extending ribs, the weight is small, and the base body has a flexibility which is desirable for many applications.

Claims

1. A support helix (1) for a radially expanded sleeve (3) of resilient material which may be used as an enclosure of an elongate object such as an electrical cable (19), the support helix being formed by a tubular base body and having adjacent turns (5, 7) interconnected in circumferentially distributed connection areas (9, 11), with non-interconnected circumferential areas of substantially the same wall thickness as the interconnected areas being provided therebetween, the non-interconnected circumferential areas being formed by cuts (23, 25)

extending through the wall thickness of the base body (21), the support helix comprising an end portion (15) which extends from one end (13) of and through the support helix (1) and can be gripped at the other end (17) of the support helix (1), the connection areas (9, 111 being dimensioned so that the support helix (1) can be manually unwound by pulling on the end portion (15), characterized in that the tubular base body (21) has a circumferentially smooth inner surface devoid of axially extending ribs to provide an essentially uniform wall thickness; and the cuts are spaced circumferentially in a helical pattern along the base body.

2. A support helix according to claim 1 wherein the cuts (23, 25) are arranged so as to avoid a linear alignment of non-interconnected areas.

3. A device for cutting the support helix of claims 1 or 2 comprising a knife wheel (31) adapted to be rolled on the tubular base body (21) in a helical line (47) having for forming the cuts (23, 25), circumferentially distributed and circumferentially spaced, radially projecting knives (45) having circumferential blades (47) extending essentially in the circumferential direction.

4. A device according to claim 3 wherein the knives (45) comprise lateral faces (49, 51) which extend generally radially and merge towards the circumferential blade (47) to form lateral blades (53, 55).

5. A device according to claim 4 wherein the lateral faces (49, 51) of the knives (45) have a convex curvature.

6. A device according to any one of claims 3 to 5 wherein the knives (45) comprise a hollow grinding (59, 61) with respect to the circumferential blades (47).

7. A device according to claim 6 wherein the knives (45) comprise hollow grindings on both sides.

8. A device according to one of claims 3 to 7 wherein a guide (69) is provided for the axial advancement of the tubular base body (721), and the knife wheel (731) is rotatably drivable.

9. A device according to claim 8 wherein the knife wheel (731) is designed and arranged for engagement into a helical peripheral groove (763) of the base body (721), the peripheral groove defining the helical line.

10. A device according to claim 8 or 9 further comprising at least one counter wheel (73) arranged for supporting the tubular base body (721) towards the knife wheel (731).

11. A device according to claim 10 wherein said at least one counter wheel (73) is arranged to engage the base body (721) on its inside wall in an area disposed oppositely of the knife wheel (731), and includes a recess (75) for the outer ends of the knives (745) penetrating through the wall (757).

Patentansprüche

1. Tragespirale (1) für eine radial ausdehnbare Muffe (3) aus einem elastischen Material, die als Umhüllung eines länglichen Gegenstands, wie zum Beispiel eines elektrischen Kabels (19), verwendet werden kann, dadurch gekennzeichnet, daß die Tragespirale durch ein rohrförmiges Basisstück gebildet wird, und daß sie benachbarte Windungen (5, 7) aufweist, die in umfänglich verteilten Verbindungsbereichen (9, 11) miteinander verbunden sind, wobei nichtverbundene, sich im Umfang erstreckende Bereiche, mit der im wesentlichen gleichen Wanddicke wie die miteinander verbundenen Bereiche, dazwischen bereitgestellt sind, dadurch gekennzeichnet, daß die nichtverbundenen, sich im Umfang erstreckenden Bereiche durch Schlitze (23, 25) ausgebildet sind, die sich durch die Wanddicke des Basisstücks (21) erstrecken, dadurch gekennzeichnet, daß die Tragespirale einen Endteil (15) aufweist, der sich von einem Ende (13) der Tragespirale (1) und durch diese hindurch erstreckt und der an dem anderen Ende (17) der Tragespirale (1) gegriffen werden kann, wobei die Verbindungsbereiche (9, 11) so bemessen sind, daß die Tragespirale (1) manuell abgewickelt werden kann, und zwar durch Ziehen an dem Endteil (15), dadurch gekennzeichnet, daß das rohrförmige Basisstück (21) eine sich im Umfang erstreckende, glatte innere Oberfläche aufweist, ohne sich axial erstreckende Rippen, um für eine im wesentlichen gleichmäßige Wanddicke zu sorgen; und dadurch, daß die Schlitze im Umfang spiralförmig entlang des Basisstücks angeordnet sind.

2. Tragespirale nach Anspruch 1, dadurch gekennzeichnet, daß die Schlitze (23, 25) so angeordnet sind, daß eine lineare Ausrichtung der nicht-verbundenen Bereiche vermieden wird.

3. Vorrichtung zum Schneiden der Tragespirale aus Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Vorrichtung eine Schneidescheibe (31) umfaßt, die so adaptiert ist, daß sie auf dem rohrförmigen Basisstück (21) in spiralförmiger Linie (47) gedreht werden kann, wobei die Scheibe zur Gestaltung der Schlitze (23, 25), umfänglich verteilte und mit zwischenabstand angeordnete, radial vorstehende Schneidemesser (45) aufweist, mit umfänglichen Klingen (47), die sich im wesentlichen in der Umfangsrichtung erstrecken.

4. Vorrichtung nach Anspruch 3, dadurch gekennzeichnet, daß die Schneidemesser (45) Seitenflächen (49, 51) aufweisen, die sich allgemein radial erstrecken und die zu der umfänglichen Klinge (47) zusammenlaufen, um so die Seitenklingen (53, 55) zu bilden.

5. Vorrichtung nach Anspruch 4, dadurch gekennzeichnet, daß die Seitenflächen (49, 51) der Schneidemesser (45) eine konvexe Krümmung aufweisen.

6. Vorrichtung nach einem der Ansprüche 3 bis 5, dadurch gekennzeichnet, daß die Schneidemesser (45) in bezug auf die umfänglichen Klingen (47) einen Hohlschliff (59, 61) aufweisen.

7. Vorrichtung nach Anspruch 6, dadurch gekennzeichnet, daß die Schneidemesser (45) auf beiden Seiten Hohlschliffe aufweisen.

8. Vorrichtung nach einem der Ansprüche 3 bis 7, dadurch gekennzeichnet, daß zum axialen Vorschub des rohrförmigen Basisstücks (721) eine Führung (69) bereitgestellt ist und dadurch, daß die Schneidescheibe (731) drehbar angetrieben werden kann.

9. Vorrichtung nach Anspruch 8, dadurch gekennzeichnet, daß die Schneidescheibe (731) so gestaltet und angeordnet ist, daß sie in einer spiralförmigen, peripheren Rille (763) des Basisstücks (721) eingreift, wobei die periphere Rille eine spiralförmige Linie definiert.

10. Vorrichtung nach Anspruch 8 oder 9, ferner dadurch gekennzeichnet, daß sie mindestens eine Gegenscheibe (73) aufweist, die so angeordnet ist, daß sie das rohrförmige Basisstück (721) zu der Schneidescheibe (731) hin abstützt.

11. Vorrichtung nach Anspruch 10, dadurch gekennzeichnet, daß die genannte, mindestens eine Gegenscheibe (73) so angeordnet ist, daß sie mit dem Basisstück (721) an dessen Innenwand in einem Bereich in Eingriff gerät, der sich gegenüber der Schneidescheibe (731) befindet, und wobei die Gegenscheibe eine Aussparung (75) für die die Wand (757) durchdringenden äußeren Enden der Schneidemesser (745) aufweist.

Revendications

1. Spirale porteuse (1) pour un manchon agrandi radialement (3) en matière élastique et qui peut être utilisé en tant qu'enceinte d'un objet allongé comme un câble électrique (19), la spirale porteuse étant formée par un corps de base tubulaire et ayant des spires adjacentes (5, 7) interconnectées dans des zones de connexion distribuées circonférentiellement (9, 11), des zones circonférentielles non interconnectées de pratiquement la même épaisseur de paroi que celle des zones interconnectées étant prévues là entre, les zones circonférentielles non interconnectées étant formées par des entailles (23, 25) qui s'étendent au travers de l'épaisseur de paroi du corps de base (21), la spirale porteuse comprenant une partie d'extrémité (15) qui s'étend depuis une extrémité (13) de, et au travers de, la spirale porteuse (1) et qui peut être saisie à l'autre extrémité (17) de la spirale porteuse (1), les zones de connexion (9, 11) étant dimensionnées de façon que la spirale porteuse (1) puisse être déroulée manuellement en tirant sur la partie d'extrémité (15), caractérisée en ce que le corps de base tubulaire (21) a une surface interne circonférentiellement unie, dénuée de nervures s'étendant axialement, afin de procurer une épaisseur de paroi sensiblement uniforme, et en ce que les entailles sont circonférentiellement espacées dans une configuration hélicoïdale le long du corps de base.

2. Spirale porteuse suivant la revendication 1, caractérisée en ce que les entailles (23, 25) sont agencées de façon à éviter un alignement linéaire de zones non interconnectées.

3. Dispositif pour entailler la spirale porteuse de l'une ou l'autre des revendications 1 et 2, comprenant un couteau circulaire (31) qui est agencé pour être roulé sur le corps de base tubulaire (21) suivant une ligne hélicoïdale (47) et qui a, pour former les entailles (23, 25), des couteaux (45) qui sont circonférentiellement distribués et circonférentiellement espacés, qui font saillie radialement et qui ont des lames circonférentielles (47) s'étendant sensiblement

dans la direction circonférentielle.

4. Dispositif suivant la revendication 3, caractérisé en ce que les couteaux (45) comportent des faces latérales (49, 51) qui s'étendent généralement radialement et qui se fondent en direction de la lame circonférentielle (47) pour former des lames latérales (53, 55).

5. Dispositif suivant la revendication 4, caractérisé en ce que les faces latérales (49, 51) des couteaux (45) ont une courbure convexe.

6. Dispositif suivant l'une quelconque des revendications 3 à 5, caractérisé en ce que les couteaux (45) comportent un affûtage en creux (59, 61) par rapport aux lames circonférentielles (47).

7. Dispositif suivant la revendication 6, caractérisé en ce que les couteaux (45) comportent des affûtages en creux sur les deux côtés.

8. Dispositif suivant l'une quelconque des revendications 3 à 7, caractérisé en ce qu'un guide (69) est prévu pour l'avance axiale du corps de base tubulaire (721) et en ce que le couteau circulaire (731) peut être entraîné en rotation.

9. Dispositif suivant la revendication 8, caractérisé en ce que le couteau circulaire (731) est conçu et agencé pour être en prise dans une rainure périphérique hélicoïdale (763) du corps de base (721), la rainure périphérique déterminant la ligne hélicoïdale.

10. Dispositif suivant la revendication 8 ou 9, caractérisé en ce qu'il comporte en outre au moins une molette antagoniste (73) agencée pour supporter le corps de base tubulaire (721) en direction du couteau circulaire (731).

11. Dispositif suivant la revendication 10, caractérisé en ce qu'au moins la molette antagoniste (73) est agencée pour entrer en contact avec le corps de base (721) par sa paroi interne dans une zone disposée à l'opposé du couteau circulaire (731) et en ce qu'elle comporte un évidement (75) pour les extrémités externes des couteaux (745) qui pénètrent au travers de la paroi (757).

FIG.1

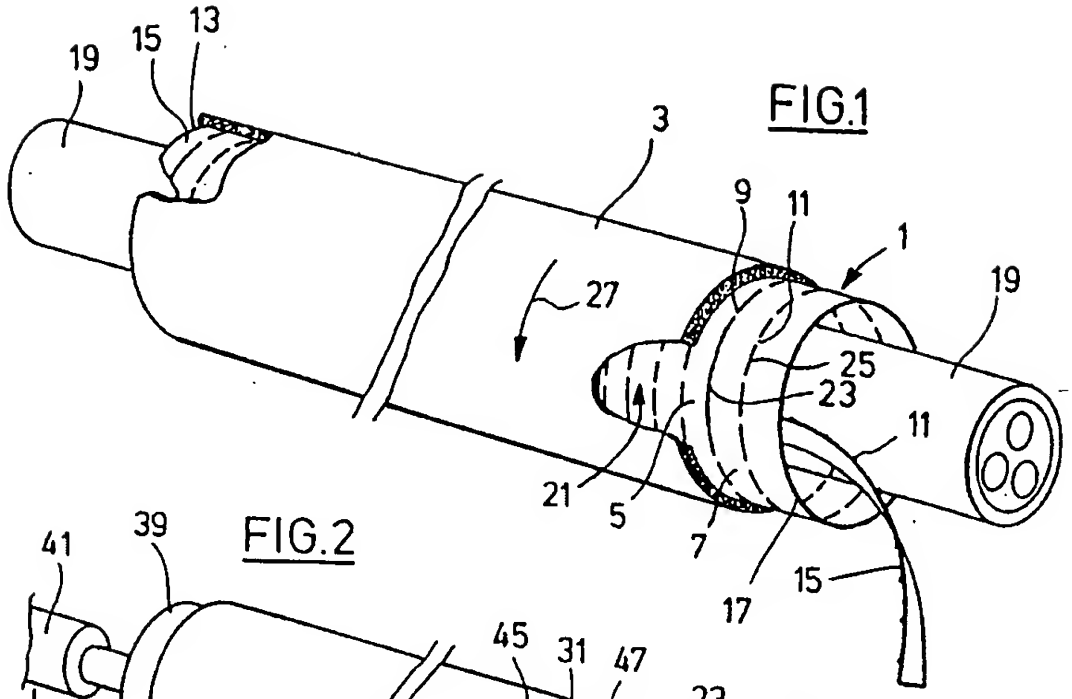


FIG.2

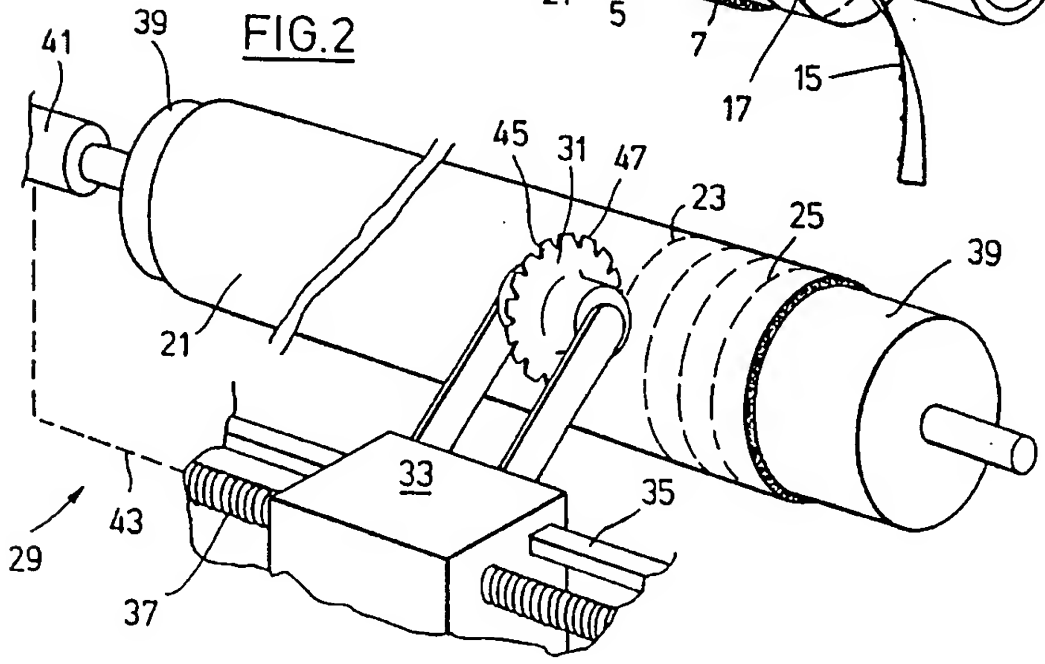


FIG.3

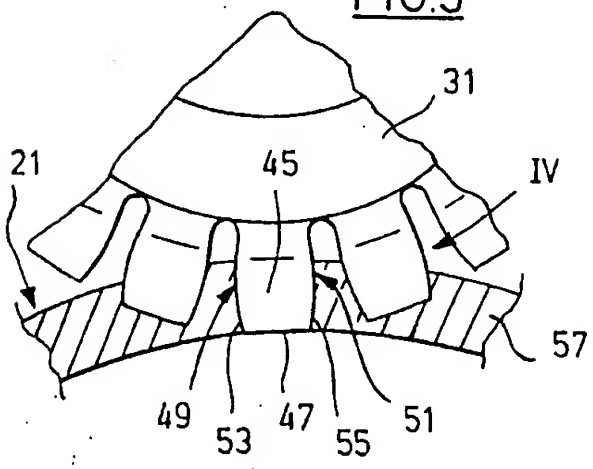
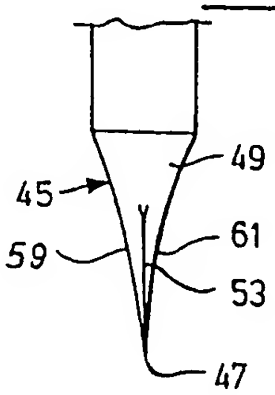


FIG.4



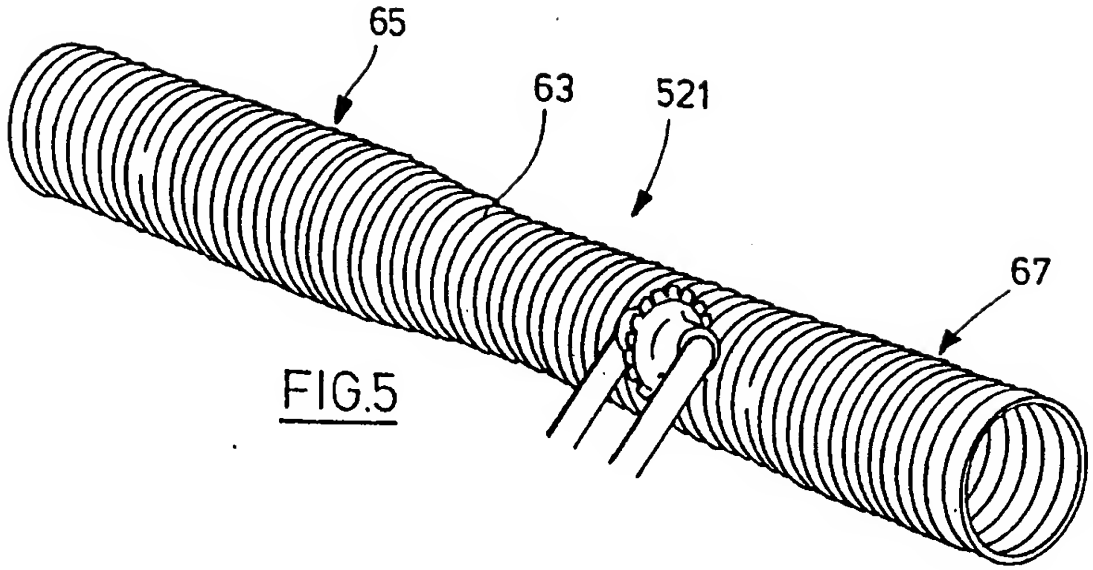


FIG.5

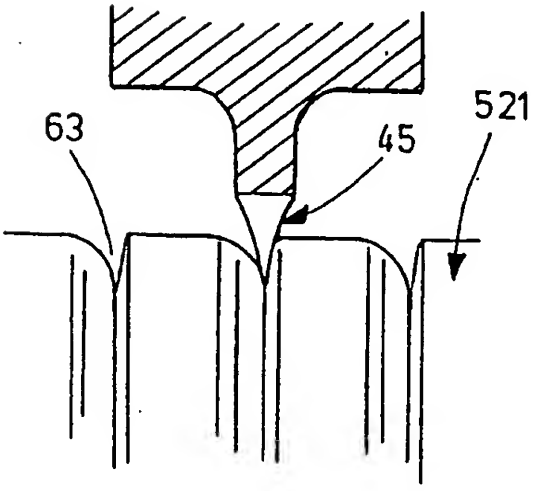


FIG.6

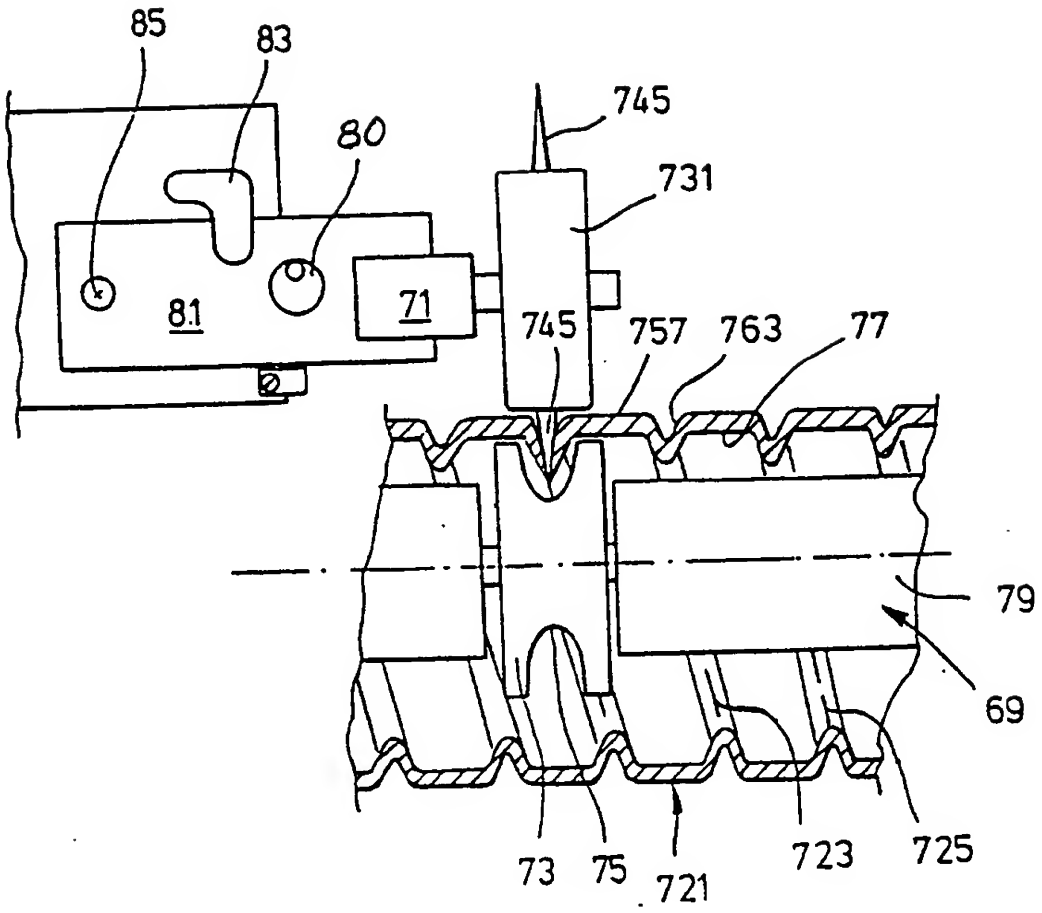


FIG.7